1988
ANNUAL
REPORT

ALBERTA SPECIAL CROPS AND HORTICULTURAL RESEARCH CENTER

Alberta
AGRICULTURE

1988 ANNUAL REPORT

ALBERTA SPECIAL CROPS AND HORTICULTURAL RESEARCH CENTER

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DIRECTOR'S REPORT

The Alberta Special Crops and Horticultural Research Center (ASCHRC) is a branch of the Plant Industry Division of Alberta Agriculture. The ASCHRC, located at Brooks, implements its province-wide crop diversification mandate through research, extension and developmental programs in horticulture, special and field crops. The ASCHRC conducts co-operative research work with the Alberta Tree Nursery and Horticulture Centre (ATNHC); the University of Alberta; Agriculture Canada; Agricultural Colleges; other Alberta Government departments; grower associations, and individual producers.

The ASCHRC programs and projects are priorized through regular review with industry and other scientists. Formal program reviews are conducted biennially. The ASCHRC staff maintain an on-going working relationship with clients and the ASCHRC Advisory Committee (see Appendix II) provides additional program direction.

The year 1988 was one of program assessment and definition. Programs located at Olds were transferred, the Seed Potato Program physically and administratively to the ATNHC, the Regional Crops Laboratory was administratively transferred to the Crop Protection Branch. Most other programs at the Center were readjusted to reflect further budgetary restraints.

Staff changes during 1988 included Judy Butt (Greenhouse Specialist), Hannah Mathers (Nursery Crops Specialist), Jim Holley (Post-Harvest Physiologist), Cathy Krause (Potato/Vegetable Agrologist), and Bernice Krause (Weed Control Technologist) joining the staff. Boyd Hanel (Potato Technologist) left the staff in December.

The ASCHRC staff continued to be actively involved in provincial, national and international organizations by participating in expert committee and advisory committee meetings, national research program reviews, and attending conferences. This level of involvement has continued to keep staff attuned to the continued changing scientific environment.

The ASCHRC annual report is intended to provide readers with a short summary of all programs. More detailed information is available by contacting the program leaders in each area.

Personally, I had the pleasure to serve as President of the Alberta Institute of Agrologists.

Thomas R. Krahn, M.Sc., P.Ag.

ADMINISTRATIVE SERVICES SECTION

The section provides administrative support to the ASCHRC including purchasing, accounting, budgetary control, personnel services, library and hostess activities, computer and Automated Information Processing, general office management and serves as the formal contact with Project Management staff of Alberta Public Works Supply and Services (APWSS).

Thomas R. Krahn, B.Sc. (Ag), M.Sc., P.Ag. ..... Director
Huber Ellis ..... Administrative Officer
Priscilla Petersen ..... Secretary & Personnel
Anna Moeller ..... Accountant
Betty Ann Humphreys ..... Receptionist & Timekeeper
Joyce Clark ..... Librarian & Hostess

During 1988 the ASCHRC continued to host a number of tours and field days. The Annual Field Day on August 19 attracted over 2,000 visitors. Other commodity oriented field days were held for fruit crops, vegetables, potatoes and herbs and spices. These field days continue to be part of the Center's overall extension and public relations program.

The ASCHRC also hosted a tour by the Board of Directors of the Agricultural Research Institute.

Staff continued to work closely with the Project Management and Property Management staff of APWSS. Construction of the laboratory addition to the Hargrave Building commenced and is on schedule. APWSS also prepared a long range development plan for the ASCHRC, which outlines facility development needs for the next five years. Authorization was received to purchase land at Bow Island for the establishment of a permanent research substation.

Automated information processing services were further upgraded with the addition of equipment, software and the development of specific local applications.

SITE OPERATIONS SECTION

This section is responsible for the grounds program, farm operations, machinery/vehicle maintenance and shop operation, activities of the stockkeeper and the Occupational Health and Safety Program. Site development, shelterbelt planning, planting and maintenance, irrigation system maintenance, mechanical preventative maintenance, land preparation and weather services are major areas of responsibility.

Joe Chomistek, B.Sc. (Ag), P.Ag. ..... Site Manager
Henry Christesen ..... Farm Manager
William Coffey ..... Stockkeeper
Roland Williams ..... Senior Mechanic
Barry Merkl ..... Mechanic
David Houseman ..... Farm Worker
Ludolf Velting ..... Farm Worker
William Wise ..... Farm Worker
Greg Feth ..... Grounds Technologist

Farm operations were maintained at an efficient level. New off-center plots were located at Duchess and Rolling Hills to accommodate needs of the Soil and Water and Field Crops programs.

Irrigation system upgrading was initiated. The pumpsite at McLeod Farm was modified by the installation of a new pumping sump. New irrigation pumps, including system automation, were installed on the Lendrum farm. A plan to upgrade the grounds irrigation system was developed but not funded.

A computer controlled gas pump system was installed to improve the fuel control system at the ASCHRC. The ASCHRC weather station was automated, allowing direct information transfer to Atmospheric Environment Services and reducing the daily manual collection of data.

The grounds program renovated and replanted the perennial border running northeast of the picnic shelter. The ASCHRC gladiola collection was dispersed with only a small collection remaining at the Center.

HORTICULTURAL CROP PRODUCTION SECTION

Programs in the Horticultural Crop Production Section provide research and extension services for Alberta's horticultural industries. The objectives of the section are: to improve the quality of horticultural crops produced in Alberta; to increase profits for producers by increasing yields and optimizing management inputs; and to promote the development of horticultural crop production. Industries supported include: fresh, processed, and seed potato; fresh and processed vegetable; greenhouse flower and vegetable; nursery and landscaping; and small and native fruit. Most of the programs include both cultivar evaluation and production research. Extension activities include workshops, short courses, field days, study groups, and individual consultation.

Section Administration and Potato Program

Clive A. Schaupmeyer, B.Sc. (Ag), M.Sc., P.Ag. ..... Section Head and Potato Specialist
Mayumi Tanigami-Bunney ..... Secretary
Annette Bergen ..... Technologist

Vegetable Crops

Paul Ragan, B.Sc.(Ag), M.Sc., Ph.D. ..... Research Horticulturist
Toru Maruno, Dipl. En. ..... Technologist
Cathy Krause, B.Sc., Dipl. Hort ..... Potato & Vegetable Agrologist

Fruit Crops

Lloyd Hausher, B.Sc.(Ag) ..... Research Horticulturist
Te-Sen Pih, B.Sc., M.Sc. ..... Technologist

Ornamentals, Nursery Crops

Hannah Mathers, B.Sc., M.Sc. ..... Research Horticulturist
Nigel Seymour, Dipl. Hort. ..... Technologist

Greenhouse Crops

Judy Butt, B.Sc.(Ag), M.Sc. ..... Research Horticulturist
Murray Briant, Dipl. Hort. ..... Technologist

POTATO PROGRAM

Program Leader: C. Schaupmeyer
Agrologist: C. Krause
Technologist: A. Bergen

The objectives of the Potato Program are to assist in the selection and development of improved potato cultivars and to establish methods for improving quality and maximizing economic yields in Alberta's potato industry. This is accomplished through research, extension, and service.

RESEARCH PROJECTS

POTATO CULTIVAR IMPROVEMENT

Prairie Potato Regional Trials

The ASCHRC co-operates in the Prairie Regional Potato Trials to select improved potato cultivars for Alberta's potato industry. Approximately 300 cultivars were grown for evaluation in five trials: the Prairie Adaptation Trial, two Advanced Adaptation Trials, the Prairie Early Replicated Trial, and the Prairie Replicated Trial. Data were collected to a maximum of 39 observations and measurements for each entry in the trials. The Center also evaluated 20 cultivars in the North Central Trial.

The data were compiled and transmitted to D. Lynch, the Agriculture Canada potato breeder at Lethbridge. Results of the regional trials are not published, however, information on clones in the trials may be obtained by contacting the ASCHRC, or D. Lynch, Agriculture Canada, Lethbridge.

Alberta Potato Industry Cultivar Evaluation

The Potato Industry Cultivar Trials were established to commercially evaluate new potato cultivars that have "graduated" from the Prairie Potato Regional Trials. The industry trials enable growers and processors to have first hand experience with new cultivars in the field and processing plant so they have direct input in the final selection of new cultivars.

Potato growers and staff from Hostess Foods Products Ltd., Old Dutch Foods Ltd., York Farms Division of Canada Packers Inc., co-operated with ASCHRC staff in the Potato Industry Cultivar Trials. In 1988, 12 new potato cultivars were evaluated. Commercial field plots of 0.2-1.0 ha, were planted at seven locations in southern Alberta. Growers planted the new cultivars in test strips 4-6 rows wide. The test cultivars were located away from the field perimeter with an appropriate standard planted on each side for comparison.

Growers were responsible for the management and cultural practices of the field plots. During the growing season the test variety and the standard were treated identically.

Early maturing test cultivars, suitable for chipping directly from the field, were planted beside Superior or Atlantic for comparison. Later maturing main crop test cultivars, suitable for late season chipping or frying from the field and storage, were planted with Norchip or Russet Burbank. The French fry cultivars were evaluated for fresh market potential (boiling and baking qualities) as well as French fry quality.

In July and August field samples were hand harvested on four dates. The sampling dates were predetermined according to crop maturity and anticipated harvest dates.

Cultivars were evaluated using the following criteria: vigor, stand count, total and marketable yield, total and marketable number, oversize yield and number, specific gravity, reducing sugars, chip color, French fry and fresh market quality.

Four new main crop chippers, W848, WIS75-17, WIS74-7 and MIN9632, were similar to Norchip in quality and will be retested in 1989. Two of the main crop chippers, W847 and W760, produced poor quality chips compared with Norchip and have been discontinued from the trials.

Two early chipping cultivars, F72004 and F76080, compared reasonably well to Superior and will be retested when seed is available.

Of the three French fry cultivars tested, A69868-2 and A74117-9 produced acceptable quality French fries when compared with the Russet Burbank standard.

In addition to the industry evaluations, seed of 13 cultivars was propagated for industry testing in 1989.

POTATO PRODUCTION IMPROVEMENT

The results of the following trials are reported in detail, along with the results from previous years, in Potato Cultural Trials 1985--1988, ASCHRC Pamphlet 89-8.

Yield and Tuber Size of Norchip and Shepody Potatoes from Three Seed Piece Types Planted at Four In-Row Spacings

Three seed piece types of Norchip and Shepody were planted at four in-row spacings to determine the effects of seed piece types on yield, number and size of potato tubers. The three seed lot types were: whole tubers only, tuber halves, and a mixture of pieces with two and three cut surfaces. All pieces weighed 60 g ±5 g, and were spaced at 15, 20, 25, and 30 cm.

There were no differences between the three seed piece types in 1988, although the whole and half tubers had positive effects on tuber

numbers, size and yields of Russet Burbank and Norchip potatoes in 1986 and 1987. The total and marketable yield of Norchip was significantly greater at the 15 cm in-row spacing than from any of the other spacings. Although not significant, the yield of Shepody tended to be greater from the plots planted at 15 and 20 cm.

The lack of differences between the three seed pieces types may have resulted from the lack of large mother tubers. Two- and three-cut surface seed pieces were created by trimming three edges from smaller tubers. The eye distribution was therefore different than had seed pieces actually been cut from larger tubers.

The Effects of Seed Piece Types on the Emergence and Stand of Minn. 10162 and Norchip Potatoes

In June, 1988, two sizes of uncut tubers of the seedling Minn. 10162 were cut into a total of five seed piece types. Small tubers weighing approximately 120 g were cut into two 60-g halves. Large tubers weighing approximately 360 g were cut into six 60-g pieces. The pieces were designated as small apical and basal; and large apical, basal, and center. The pieces were planted in a greenhouse and the stand on two dates and final stem count were recorded. In January, 1989, tubers of Norchip ranging in size from 100 to 375 g were cut into seven different seed pieces as follows: small apical and basal; medium apical and basal; and large apical, basal, and center. All pieces weighed approximately 60 g and were planted in a greenhouse. Date of first emergence and final stand were recorded.

In the first trial the apical portion of both the small and large tubers had a significantly higher stem count. The basal portions from the larger tubers had a significantly lower final stand than any of the other seed piece types. In the second trial the center portions from the large tubers had a significantly lower final stand than any of the other seed piece types. Both studies indicated that basal or centre portions from large tubers can significantly reduce final stands.

The Effects of Seed Piece Type Distribution in Two Seed Lots on the Yield, Size, and Tuber Numbers of Norchip and Russet Burbank Potatoes

Two seed lots composed of different proportions of four seed piece types were planted. One lot consisted mainly of tuber halves and whole tubers, the other consisted of a mixture of pieces including portions with two and three cut surfaces which were to be cut from large mother tubers. Because the ASCHRC did not have a supply of large mother tubers, the two- and three-cut surface portions were manufactured from smaller tubers. There were no differences in yield and size of tubers harvested from the two seed lot treatments. Presumably the resulting seed portions had a different eye distribution than if they had actually been cut from large tubers.

The Yield and Size of Russet Burbank, Norchip, and Superior Potatoes Planted on Five Dates and at Two Planting Depths

Seed pieces of three cultivars, Russet Burbank, Norchip, and Superior, were planted on five dates and at two depths below the peak of the hill formed by the planter. Superior was planted on April 11, 21, May 3, 12, and 24. Russet Burbank and Norchip were planted on April 21, May 3, 12, 24, and June 3. They were planted at 10 and 15 cm below the hill peak. Norchip and Russet Burbank potatoes were planted for early and late harvests.

There were no practical differences in the two planting depths on the yield, quality or size of any of the three cultivars.

The total and marketable yield of Russet Burbank and Norchip were lower on the last two dates and there were no differences between the first three dates. The yield of Superior was highest from the first two dates, although the yields from second and third dates were not significantly different. The data from this study and from previous trials indicate that there is no difference in yield of Norchip and Russet Burbank potatoes planted between April 20 and May 10-15. Although Superior yields were higher when planted on the first two dates in 1988, they yielded more potatoes from an early May planting in 1987 because of a late frost that damaged plants planted on April 21.

The Yield and Size of Four Cultivars Planted at Different In-Row Spacings

Atlantic, Shepody, Carlton, and Sangre potatoes were planted at 15, 20, 25, and 30-cm in-row spacings and harvested on two dates to simulate seed production and main crop production.

Total and marketable yields of Shepody were significantly higher from the three closest spacings than from the industry standard 30-cm spacing. Because of seed costs, the 25-cm spacing would therefore be recommended for commercial growers, however, closer spacings tended to reduce mean tuber size which might be of significance to either processors or seed growers.

The yield of Carlton was similar from all four spacings, however, the size was reduced at closer spacings. The yield of Atlantic from the different spacings was not significantly different according to Duncan's multiple range test, however, there appeared to be a linear relationship between in-row spacings and yield: the yield declined as spacing increased. There were no significant differences between the yields of Sangre planted at four spacings, although the 30-cm spacing produced lower yields. Tuber size increased as spacing increased.

SERVICE PROJECTS AND EXTENSION

The ASCHRC potato program propagates seed of approximately 200 cultivars for the Prairie Potato Breeding Program regional trials in Alberta, Saskatchewan and Manitoba. Approximately 200 hills each of advanced seedlings and 50 hills each of early lines are grown and stored at ASCHRC.

Staff provide extension service to growers and industry personnel through direct contact, newsletters and factsheets, and presentations at conferences and workshops.

VEGETABLE PROGRAM

Program Leader: P. Ragan
Technologist: T. Maruno

The Vegetable Program serves the fresh and processing sectors of a growing vegetable industry through applied field research and industry extension activities. The fresh vegetable industry in Alberta consists of both commercial (wholesale) and market garden producers plus processing growers that provide vegetables for the canning and freezing industry. Research activities emphasize cultivar evaluation and earliness enhancement of crops through improvements in cultural management. An extension role through on-farm visits and participation in commodity organizations/activities serves to educate and strengthen members of the industry.

RESEARCH PROJECTS

CULTIVAR EVALUATION

Details of results on cultivars tested are reported in ASCHRC Pamphlet 89-5.

There were 850 cultivars representing 18 different crops on trial. Treatments consisted of comparisons between direct seed and transplant, early spring and late spring seedings, plus successive seeding regimes of select cultivars. Many of the entries, particularly among processing crops, represent advanced breeding lines from Europe and the United States. Final evaluation of storage crops such as carrots, cabbage and cooking onions included a 6 month storage quality assessment.

CULTURAL TRIALS

Detailed results of cultural trials and discussion of results are reported in ASCHRC Pamphlet 89-4.

Plant Population

Brussels sprouts were tested in a plant population trial to evaluate the response in maturity and yield that would occur with this crop. Nine population densities ranging from 4.3 to 14.5 thousand plants per acre indicated overall yield of Oliver was most effectively increased by closer spacing of plants in the row. Large grade sprouts occurred at a higher frequency as both in-row and between-row spacings increased.

Yield of medium sized sprouts increased most significantly with larger distances between rows along with closer spacing of plants in the row.

Plasticulture

Both traditional production practices and new technological plastic innovations designed to provide frost protection for vegetables were tested for their commercial value in pepper and cucumber production. When compared with a hotcap treatment, the floating mulch, Reemay, resulted in earlier and higher yields of green pepper fruit. Individual fruit weight was also higher than under the hotcap treatment. Yields of slicing cucumbers under floating mulch were lower than in the no cover treatment, which ran counter to expectation. A greatly aggravated weed problem under the floating mulch undoubtly influenced the results.

Repeated manual hoeing of weeds would suggest the benefits of black plastic mulch in controlling weeds whenever a floating mulch cover is used.

Five commercially available products of the plastic industry were tested for their effects on pepper yield and earliness. Both the wall o'water and protecta-cap hindered growth. Unseasonably hot weather resulted in leaf scorch and stunted growth under these products. The hotcap clearly resulted in the earliest yields among all treatments. By season's end, both the plastic row cover and floating mulch treatments produced significantly higher yields than all other treatments.

Fall Planting

Fall planting of garlic is feasible in Alberta if some form of overwintering mulch is provided. This trial was designed to test several options suitable to overwinter garlic. Cloves of garlic planted September 10, 30 and October 30 were mulched with straw, Remay and a soil ridge technique. Record of clove survival indicated later plantings improved survival as did the straw mulch cover. Straw mulch proved to be the best cover, however, once removed the resulting problem with volunteer grain can be a concern.

Fall seeding crisphead varieties of lettuce resulted in a generally heavier and larger head over the spring seeded treatment. Treatment comparisons between cos, leaf and butterhead types failed to show a significant difference in yield. The 13 day earlier harvest advantage in all lettuce types tested in fall seeding can be an economic advantage.

Succession Seeding

Succession seeding trials are designed to provide insight into physiological response in vegetables as a consequence of seasonal environment changes such as temperature and day length. Seven sowings of broccoli on a 10-day seeding interval indicated that earlier seedings matured significantly slower and as the season advanced, later seedings produced better quality and higher yields. Beyond a mid-June seeding, yields began to decline. Late June and later seedings failed to mature.

EXTENSION AND SERVICE ACTIVITIES

Aside from a one-to-one, on-farm extension service provided to the southern region of the province, the following major activities were conducted. The specialized equipment loan is a zero cost program to producers designed to aid in technology transfer; popular items included precision drills, transplanters and plasticulture equipment.

The Stanhay precision drill seed belt punching and calibration service provides producers with this drill an opportunity to match seed size to desired seed drop to better control plant density in the field.

A research plot and commercial equipment demo field day for producers and researchers from Alberta, Saskatchewan and Manitoba was held in July as an education opportunity in equipment development and production research.

Production courses for beginning market gardeners and a marketing seminar for commercial growers were held in the winter months.

Revision of 1989-90 issue of Alberta Vegetable Production Guide was completed.

Secretarial services to the Alberta Vegetable Advisory Committee were provided.

Editorship to both a commercial industry and market gardener newsletter was provided. These newsletters were released on a monthly basis as a tool to keep producers informed on developments in the industry.

Numerous talks to amateur gardening groups were also given.

FRUIT CROPS PROGRAM

Program Leader: L. Hausher
Technologist: P. Pih

The Fruit Crops Program serves the growing berry and bush fruit industry in Alberta through applied research, development, and extension activities. Strawberries, raspberries, and saskatoons are emphasized although other fruit crops are being evaluated for commercial potential. Extension and developmental activities are carried out with producers and producer organizations.

RESEARCH PROJECTS

Details on cultivar evaluation and cultural trials are reported in ASCHRC Pamphlet 89-6, 1988 Fruit Crop Trials.

STRAWBERRIES

Evaluation of Junebearing Strawberries for Yield and Winter Hardiness

Sixteen cultivars of strawberries were established in replicated blocks at the ASCHRC, Brooks, and ATNHC, Edmonton in 1987. Two identical blocks were established at each location, one protected during the winter with straw mulch, the other left unprotected.

Straw mulched strawberry cultivars at Edmonton yielded 200%-300% higher than the same unmulched cultivars. At Brooks, yields from most mulched rows yielded at least 50% more than unmulched cultivars.

Total yields surpassing 20 t/ha were observed from Kent, Bounty, Glooscap, and Honeoye at both locations. The cultivars Bloomidon and Sparkle also performed well in this first year production.

Seven advanced strawberry selections from the previous ASCHRC breeding program were evaluated in a replicated trial at ASCHRC. Three selections produced at least 22 t/ha in total yield.

Ten Junebearing strawberry cultivars were established in 1988 in a single row observational trial at a site near Beaverlodge.

Winter Protection Evaluation of Junebearing Strawberries

Replicated trials were established at ASCHRC and ATNHC to evaluate the effectiveness of clear polyethylene mulch, and poly in combination with straw for winter protection. Straw mulch and no mulch were used as controls. Results from the two locations varied widely, and no trends were observed.

Evaluation of Day-Neutral Strawberry Cultivars for Yield and Hardiness

Nine day-neutral cultivars established and harvested in 1987 at ASCHRC and ATNHC were overwintered with straw protection. Plant survival and yield potential was established. Total yields equivalent to at least 27 t/ha were obtained from Hecker, Fern, Tristar, Tribute, and Brighton at the Brooks location. Only Fern and Tribute produced acceptable yields (16+ t/ha) at the Edmonton site.

An observational trial was established in 1988 at ASCHRC, ATNHC and a site near Beaverlodge including six day-neutral cultivars. All cultivars produced in excess of 20 t/ha at the Brooks site. Hecker, Fern and Tristar surpassed 20 t/ha at Edmonton.

Replicated trials of the top four day-neutral cultivars were established at ATNHC and ASCHRC. The cultivars Hecker and Tristar produced total yields in excess of 25 t/ha at Brooks. The cultivars Hecker and Fern produced in excess of 22 t/ha at the Edmonton location.

Day-Neutral Strawberry Management

A trial studying the effect of derunnering and deblossoming two cultivars of day-neutral strawberries was established at ASCHRC and ATNHC. Increased total yields of Hecker were obtained at Brooks with the deblossom/derunner treatment. Yields of Tristar were marginally better at the Brooks site with the total management system. Results at the Edmonton site were varied.

An observational experiment was established at ASCHRC to evaluate the response of Hecker strawberry to three colors of polyethylene mulch and two row covers. No treatment outyielded the control planting.

RASPBERRIES

Thirteen cultivars and ten selections of summer fruiting raspberries were established in 1987 at ASCHRC. Yields were not obtained in 1988. Single rows of the cultivars were established in 1988 at ATNHC and the site near Beaverlodge.

Three selections and one cultivar of primocane raspberry, established in 1987 at ASCHRC, fruited in 1988. One Morden selection yielded the equivalent to 11 t/ha

BUSH FRUITS

Replicated plantings including 11 cultivars of saskatoons were established in 1988 at ASCHRC, ATNHC and a site near Beaverlodge. The cultivars being evaluated include: Forestburg, Moonlake, Northline, Pembina, Parkhill, Honeywood, Regent, Pearson II, Smoky, Thiessen, and Success.

A trial evaluating types of saskatoon planting stock was established in 1988 at ASCHRC and ATNHC. Saskatoon seedlings, suckers and clonal plant material of Northline and Smoky were established.

Superior seedlings of Mongolian cherries were selected for further study.

No harvest was carried out of black currants due to poor production in 1988.

EXTENSION AND SERVICE ACTIVITIES

Monthly publication of a producer oriented newsletter, Fruit Facts, continued. Three berry production schools were conducted for commercial growers and research field days were held at the three berry crop test locations in Alberta. Assistance was given in the bulk ordering of strawberry plants for Alberta producers.

L. Hausher continued secretarial duties of the Alberta Horticultural Congress and Trade Show and the Alberta Market Gardeners' Association.

The initial writing of the Prairie Strawberry Production Guide was completed with printing to occur early in 1989.

Numerous presentations were made to research, commodity, and advisory groups throughout the year.

ORNAMENTALS PROGRAM

Program Leader: H. Mathers
Technologist: N. Seymour

OBJECTIVES

The Ornamentals Program in 1988 began a new emphasis on critical type experimentation. Seventy percent of the program will be devoted to research. Selection and breeding for improved adaptation and stress resistance will become the most vital parts of the program. Studies to determine the influence of cultural practices on winter survival and marketability will also be stressed.

As the nursery and landscape industry of Alberta moves towards a strong emphasis on container production, studies to make overwintering of container material less laborious and more cost-effective become a high priority.

The program also continues to be actively involved in demonstration trials to evaluate ornamental material for cold resistance. A new extension emphasis will be placed on marketing and promotion of Alberta grown stock. The nursery/landscape industry in Alberta is assisted through extension, relay of information to commodity groups within the Landscape Alberta Nursery Trades Association (LANTA), publication of research articles in trade magazines and scientific journals, and presentation of papers at congresses and conferences.

RESEARCH PROJECTS

NURSERY PRODUCTION

Details on these trials are available by requesting ASCHRC Pamphlet 89-2, Ornamental Research Program.

Stacking Patterns and Dormancy Evaluation Experiment Under Microfoam

In the late fall of 1988 a large-scale testing program to evaluate seven types of overwintering environments was undertaken. The results showed that stacking and covering with microfoam afforded the most effective temperature modification and winter protection. Plants were found to be fully deacclimated by the end of January, therefore, removal

of plastic early in the spring should be emphasized. Bottom-heat was not found effective for overwintering survival and the combination of plastic structure and microfoam was not advantageous to survival.

Propagation Timing Trial 1986-1988

Softwood cuttings of 20 different species of ornamental woody plants were propagated at intervals of 1 week, for a period of 12 or 13 weeks. Twenty-five cuttings were taken per plant, per week (five replicates, five cuttings per replicate). This procedure was followed for 3 years, 1986, 1987 and 1988.

The trial was established to determine three factors: 1) the optimum time of propagation for each species; 2) extended propagation season for commercial nurserymen, and; 3) to what extent season influences successful rooting.

The variation in the data sets was quite high, therefore, any clear trends in the studies were masked.

Despite the variability found within the data sets, recommendations can be made for optimum time to propagate each species investigated. A characterization of the season was also established indicating the relative success for rooting at slower times in the nursery operation.

Screening Seedlings For Cold Resistance

In the fall of 1988 three seedling screen experiments were established. The experiments will be on-going in the 1989 season. Appropriate acclimation routines will be discovered in order to identify cold hardy transgressive segregants from a variety of ornamental seedling populations.

WOODY ORNAMENTALS

Woody Ornamental Plant Trials

The woody ornamental plant trials, Pamphlet 89-3, was revised and is available. An extensive update was done of the prairie regional trial material using a list obtained from E. B. Casement of the ATNHC. The publication includes the nurseryman's evaluation trials, the UBC trial material as well as the prairie regional trial plantings as far back as 1958.

Regional Woody Plant Test Program

This co-operative trial between LANTA and Alberta Agriculture commenced in 1983. Evaluations of woody shrubs and trees are conducted at ASCHRC and nurseries in southern Alberta, as well as at the ATNHC, Edmonton, and nurseries in northern Alberta.

Further information on this trial is available from the Director of ATNHC, Edmonton.

Forest Genetics Trial

This trial is maintained for the Alberta Forest Service, which is co-operating with Proctor and Gamble Cellulose Ltd., Grande Prairie, to evaluate the effect of latitude changes on growth rates and time of flowering of several tree species. The trial is on-going with grafted white spruce clones, seedling white spruce strains, seedling tamarack, Engleman spruce, black spruce, lodgepole pine, Raviola larch, and Siberian larch.

SERVICE PROJECTS

Golden Prairie Arboretum

Since 1981 over 500 cultivars of woody ornamentals have been established in the Golden Prairie Arboretum. This is the largest single collection of deciduous ornamentals in Prairie Canada and serves the public and nursery industry in Alberta. By the end of the 1988 season all Fraxinus species in the arboretum, with the exception of 'Kindred' had been infected with the Ash Bark beetle, Hylesinues californicus. Well-established Fraxinus sp. Fraxinus nigra 'Fallgold' and Fraxinus pennsylvanica 'Patmore' were replaced with unaffected trees. Fifteen species were added or replaced in the arboretum in the 1988 season.

This season the honeysuckle aphid, Hyadaphis tataricae attacked and caused major deformation to all the Lonicera tatarica cultivars. The Lonicera xylosteum cultivars were most resistant to attack. A revised list of the deciduous woody material in the arboretum is available in Pamphlet 89-1.

Forever Green Pinetum

A new collection of plant material at the ASCHRC was formally established in 1988. The Forever Green Pinetum serves as a special collection of plant materials devoted solely to coniferous material. Copies of the Forever Green Pinetum pamphlet listing the coniferous material present can be obtained through the ASCHRC Library under Pamphlet 89-12.

GREENHOUSE CROPS PROGRAM

Program Leader: J. Butt
Technologist: M. Briant

The greenhouse crops program at ASCHRC serves southern Alberta's greenhouse vegetable and ornamental industry by providing a high degree of extension service and conducting applied greenhouse research trials. Extension services include provision of crop cultural information, diagnosis of crop disorders, and soil and tissue test interpretations.

RESEARCH PROJECTS

Details of the following trials are reported in ASCHRC Pamphlet 89-13, 1988 Greenhouse Research Program.

VEGETABLE CROPS

Cucumber Production on New and Used Rockwool Substrates at Three Rockwool Temperature Regimes

The performance of two long English seedless cucumber cultivars, Brudania and Farona, grown on new or used rockwool slabs and at three rockwool temperatures (1) 10-15°C, (2) 22-24°C, and (3) 26-28°C, was evaluated to determine the optimum slab temperature and if re-use of slabs reduces yield. Brudania, on new or used rockwool slabs, showed no difference in fruit number or weight between the three temperatures. The king grade (+37 cm length) of Farona, however, showed decreased yield and fruit number at 28°C on used slabs but lower yield and fruit number at 10-15°C when grown on new slabs.

Tomato Production on New and Used Rockwool Substrates and Two Seeding Dates

A trial was initiated to evaluate the performance of four greenhouse tomato cultivars (Dombito, Caruso, Counter and Laura) at two seeding dates (October 1, 1987, and November 2, 1987) on new or used rockwool slabs. There were no significant differences in yield and fruit number between the two seeding dates or the new or used slabs. There were, however, yield and fruit number differences between the cultivars. The yield of Caruso, Dombito and Laura were similar with Dombito yielding the highest of the three cultivars. Counter is a small-fruited cultivar and produced significantly less than the other cultivars.

Greenhouse Cucumber Production in a Nutrient Film Technique System - Grower Demonstration Trial

A nutrient film technique (NFT) system was constructed in a commercial greenhouse to demonstrate to local growers the production of greenhouse cucumbers in a hydroponic system. There are no commercial NFT systems used in the Medicine Hat-Redcliff area. A short fall crop was produced with seeding on August 1 and final harvest on October 25. The marketable yield was 11.3 cucumbers per plant.

FLORICULTURE CROPS

Ficus Potting Medium Trial

A co-operative trial between ASCHRC and Altwin Distributors, Medicine Hat, was undertaken to evaluate the effect of six combinations of sedge peat, sphagnum peat and earthworm castings as a potting medium on the growth of Ficus benjamina. There were no differences between media in plant height, leaf dry weight or stem dry weight. Media containing high proportions of earthworm castings or sedge had poor water infiltration and a high degree of shrinkage. While this did not influence

yield, it did cause management problems that would be undesirable in a commercial operation.

Alstroemeria Demonstration Trial

Yield of ten alstroemeria cultivars (Cyprus, Jacqueline, Minas, Olympia, Ontario, Ostara, Paloma, Vanitas, Victorine and Westland) was evaluated over a 12-month period. There was a considerable range in the number of stems produced per square metre. Ostara was a low producer with only 64 stems/m^2 while Vanitas and Minas showed high production with 320 and 285 stems/m^2, respectively.

EXTENSION PROGRAM

The greenhouse extension program consisted of mainly personal visits by J. Butt to individual commercial operations. An average of 60 greenhouse visits per month were maintained. J. Butt attended the Canadian Greenhouse Conference in October.

SPECIAL CROPS AND AGRONOMY SECTION

This section has facilities and technical resources to conduct applied research, extension, and development services on special crops such as pulse crops, field corn, mustard, sunflower, and other new crops. The section is also responsible for cereal and oilseed cultivar testing and forage evaluation. Water management of crops and the relationship of irrigation and soil management to crop productivity are also researched by this section. Cultivar evaluation and management studies (including intensive crop management) are major emphases of the section. Research and extension projects are conducted co-operatively with numerous other agencies.

Section Administration and Special Crops Section

Refe Gaudiel, B.S.A., M.Sc., Ph.D. .. Section Head & Research Agronomist
Collin Wildschut, Dipl. Hort. ..... Technologist
Pat Moskaluk ..... Secretary

Field Crops

Henry Najda, B.Sc., M.Sc., P.Ag. ..... Research Agronomist

Soil and Water

R. Colin McKenzie, B.S.A., M.Sc., Ph.D., P.Ag. ..... Research Agronomist
Neil Clark ..... Technologist

SPECIAL CROPS PROGRAM

Program Leader: R. Gaudiel
Technologist: C. Wildschut
Seasonal Technologist: M. Romuld
Seasonal Technologist: E. Russell

The Special Crops Program is responsible for applied research, extension, and development work on alternate and new crops for Alberta. The program also provides service to other departmental staff and commodity organizations as resource specialists and through co-operative tests and in demonstration plots.

A detailed report of research projects involving pulse and other special crops will be published in the ASCHRC pamphlet series in 1989.

RESEARCH PROJECTS

EVALUATION OF CULTIVARS AND CULTURAL PRACTICES FOR DRYBEAN PRODUCTION

Drybean Cultivar Trials

Eighteen screening, observational, adaptability, and advanced yield tests were conducted at Brooks, Bow Island, Standard, and Rolling Hills to evaluate the performance of various cultivars, selections, and breeding lines of drybeans. The Drybean Prairie Cooperative Test, an official test sponsored by the Western Expert Committee on Grain Breeding for the purpose of varietal registration, was first initiated this year and conducted at Bow Island and Brooks by the ASCHRC. Several experimental lines of pinto, pink, small white, great northern, small red, and black bean types were observed to be earlier and yielded as good or better than the standard cultivars. Most of the small white/navy type lines and cultivars that were upright, tall, and narrow in growth habit were still late maturing. A few, however, appeared to be early and tall enough for direct harvest operation in the warm, long season areas of Alberta. Most of the black lines selected in 1987 for their tall and upright plant architecture were observed to be late maturing and low yielding.

The adaptability test at Standard was affected by zinc deficiency resulting in the delay of maturity, especially with the small white cultivars. Highest yielding were the early-maturing cultivars of pintos and small reds. In a preliminary dryland test at Rolling Hills, the cultivars developed at Washington in a root rot environment were the highest yielders, an indication that these cultivars have a vigorous and extensive root system.

Cultural Trials of Drybeans

A foliar fertilization test was conducted at Bow Island to determine the effects of spraying different kinds and formulations of chemical fertilizers on the foliage of two drybean cultivars. One of the cultivars was not harvested because of poor stand and uneven growth. Foliar application of soluble macro- and micronutrients, either once or twice in the growing season, did not increase the yield of the drybean pinto UI 111. An exception was the application of urea which resulted in an increase of yield over the check.

Several of the tall, upright cultivars of drybeans were grown at different row spacings at Brooks to determine the performance of these cultivars at higher population density and their feasibility for direct harvest. Certain cultivars, especially those that were taller and narrower in growth habit, appear to be suitable for high density planting and direct harvest operation.

EVALUATION OF CULTIVARS AND CULTURAL PRACTICES FOR PULSE CROP PRODUCTION

Cultivars and breeding lines of fieldpeas, lentils, fababeans, soybeans, lathyrus, lupins, and chickpeas were again evaluated at Brooks, Bow Island, Standard, and Acadia Valley. All the tests at Acadia Valley

were abandoned because of poor and uneven stand. At Brooks and Bow Island, certain plots were discarded because of poor emergence and stand. Most of the fieldpea and soybean tests at Bow Island were not harvested because of poor stand and uneven growth.

The fieldpea observational, regional, and advanced yield tests showed a number of breeding lines and cultivars that were earlier in maturity and higher yielding than the standard commercial cultivars. Most promising were several European cultivars that were semi-leafless, erect in canopy growth, and early maturing, but still yielded as well or better than the best yielding standard cultivars. The Austrian winter pea cultivars were lower yielding than the regular fieldpeas.

Among the experimental lines of lentils tested under both dryland and irrigated conditions, only Red Eston 14 approached the yield of the high-yielding standard cultivar, Eston. In 1989, Red Eston 14 is expected to be registered with the hope of replacing red lentils consumed and imported into Canada.

Fababean lines selected from Lacombe in 1987 were planted at Brooks in 1988 for further selection. The selections made in 1988 will be returned to Lacombe in 1989 for additional evaluation and selection. Certain determinate fababean cultivars received from Europe were as early and yielded as well as the local standard indeterminate cultivars.

There was no soybean line that was exceptionally better than the check cultivars. A few selections of lathyrus that were low in the neuro-toxic factor were as early to mature and yielded only slightly lower than the old standard cultivars. Most of the lathyrus lines outyielded the fieldpea check. The lupins and chickpeas evaluated at Bow Island were very late to mature because of excess moisture later in the season that allowed these indeterminate plants to further extend their growth. The desi type chickpeas appear to be better suited for production in southern Alberta than the kabuli types.

EVALUATION OF CULTIVARS AND CULTURAL PRACTICES FOR PRODUCTION OF OTHER SPECIAL CROPS

Cultivars and lines of safflower, mustard, canary seed, and hybrids of sunflower were evaluated at Brooks, Bow Island, Taber, Standard, and Acadia Valley. The safflower test at Acadia Valley was not harvested because of poor stand. Safflower lines originally selected for higher oil content continued to show maturity and yield that are comparable with the standard cultivar, Saffire. The cultivars developed in Montana were all late in maturity. No new experimental lines of mustard or canary seed were observed to be better in maturity or yield than the standard cultivars. At both dryland and irrigated tests, confectionery sunflower hybrids that produced high yields and high percentages of large seeds were Sigco 974, Sigco 954, and Interstate 8004. A few oilseed sunflower hybrids were early but slightly lower yielding than the standard hybrids.

A seeding date test and seeding rate tests with safflower at three different soil moisture levels were conducted at Rolling Hills and

Brooks, respectively. The seeding date test was abandoned because of the very dry spring that delayed emergence of the earlier seeded treatments. The highest seeding rate of 30 kg/ha gave the highest yield at all soil moisture treatments covering dryland, partial irrigation, and full irrigation conditions. Varying the plant populations did not greatly affect the yield of two confectionery sunflower hybrids; however, the percentage of large seed produced was inversely proportional to plant population in both hybrids.

EVALUATION OF ADAPTABILITY OF HERB AND SPICE CULTIVARS AND AGRONOMIC STUDIES

This project was funded by the Farming for the Future program to determine crop adaptability, certain basic agronomic practices, and realistic obtainable yield levels. Over 100 annual and perennial crops and cultivars were planted at Brooks to determine their yield and adaptability. Row spacing and seeding depth trials were conducted with a number of crops. Generally, plants which were short with less vigorous growth yielded better when seeded in narrow rows. Most of the crops with seeds smaller than mustard emerged better when seeded shallow (0.65 cm). Yield estimates of seed and essential oil were determined for a number of crops. Dill and coriander have the potential of producing 1000 and 3000 kg/ha of seed, respectively. The production of more than a dozen aromatic plants in large sized plots and the use of a semi-commercial distillation unit to extract the oil indicated that crops such as dill can produce essential oil as high as 100 kg/ha. Other crops including summer savory, fennel, and hyssop yielded approximately 15-20 kg/ha and basil approximately 10 kg/ha. Most probably, the low essential oil yields obtained from some crops was probably due to the distillation procedures used. The percent recovery of oil from plants distilled in the large distillation tub system was lower than the percent recovery of essential oil from plants distilled in the laboratory glass distillation units. There appears to be a potential for certain herb, spice, and essential oil crops in Alberta as long as profitable markets are available.

CORN AND SORGHUM CULTIVAR AND CULTURAL STUDIES

Tests of grain and silage corn hybrids were conducted at Brooks and Bow Island as part of the Alberta Hybrid Testing Program sponsored by the Alberta Corn Committee. Combined results of all the tests are used to recommend hybrids for registration and to make hybrid recommendations to Alberta growers. Approximately 40 silage and 30 grain hybrids were evaluated at both irrigated sites.

The result of the Bow Island tests for grain and silage were discarded because of variability caused by uneven and delayed emergence. The extremely long growing season (the first killing frost occurred in mid-October) enabled all the hybrids to mature properly. Silage and grain yields were high and several grain hybrids were observed to be earlier in maturity and as good in yield as the standard hybrids. These early hybrids have the potential of extending the area where corn can be grown. They will further reduce the risk in areas where corn is now being grown.

FIELD CROPS PROGRAM

Program Leader: H. Najda
Seasonal Technologist: M. Madge

The Field Crops Program of the ASCHRC is part of the Special Crops and Agronomy Section. Field research is conducted on traditional cereal, oilseed, and forage crops to provide up-to-date information and to investigate nontraditional uses of these crops as options for the producer.

Four major projects involving over 80 trials were conducted at various locations in southern Alberta. The main testing site is located at McLeod Farm at the ASCHRC; other sites are located at Standard, Acadia Valley, and Bow Island.

Several trials are conducted in co-operation with other research institutions and agencies. These include Agriculture Canada Research Stations at Beaverlodge (forage seed production), Lacombe (annual forages), Saskatoon (forage seed production), Swift Current (triticale), and the Field Crops Branch, Alberta Agriculture (cereals and oilseed). New crop varieties are also obtained for testing from universities and research agencies in Canada and abroad.

The hot, dry weather during most of the 1988 growing season caused delayed emergence in some early seeded crops. Harvesting of cereal and oilseed crops began in mid-August, compared with September in 1987, as weather conditions promoted rapid maturation of these crops. All of the forage trials seeded this year suffered from drought since adequate moisture reserves were not available for the seedling plants. Irrigation alleviated this problem although some stands were abandoned because of uneven establishment.

RESEARCH PROJECTS

CEREAL AND OILSEED CULTIVAR EVALUATION

Cereal and Oilseed Regional Tests

Trials co-ordinated by the Field Crops Branch, Alberta Agriculture at Lacombe were used to evaluate all recommended varieties, new varieties, and breeding lines of hard red spring wheat, durum wheat, utility wheat, barley, oats, triticale, flax, and canola. The ASCHRC is responsible for three irrigated sites (Brooks, Bow Island and Standard) and one dryland site at Acadia Valley in southern Alberta. Information from these trials, which include more than 30 sites province-wide, is used by the Cereal and Oilseed Advisory Committee to update recommendations. The committee annually produces a factsheet entitled Varieties of Cereal and Oilseed Crops for Alberta."

Irrigated regional trials were well established and the dry conditions of August enabled harvesting to be completed by mid-September. The Acadia Valley site suffered severe drought in the spring

which resulted in delayed and uneven emergence. Heavy rains in June caused flash floods which destroyed some trials.

Other Cereal Projects

The ASCHRC co-operates with the Field Crops Branch of Alberta Agriculture, Lacombe, with their breeding program of 2-row and 6-row barley, triticale, winter triticale, and winter wheat. The progeny and advanced line tests provide agronomic data that are used in the selection process for determining new varieties suitable for irrigated areas. Triticale grain and silage trials are conducted in co-operation with the Expert Committee on Grain Breeding.

ANNUAL FORAGE CROP STUDIES

Silage Trials

Several variety trials on annual forages for use as silage were conducted in 1988. The crop species evaluated included barley, oats, utility wheat, triticale, field pea, fababean, and forage sorghum. This was the second year of testing and the results will provide a database on variety performance for making recommendations.

In the 2-row barley trial, Klages had the highest dry matter and protein content while Scout, a hull-less, 2-row barley had the lowest yield over 2 years. Heartland, a 6-row barley, had the highest yield while Samson, a semi-dwarf variety, yielded higher than several taller varieties. The utility wheat, Fielder, produced 7% more dry matter than Wapiti triticale in the same test. Dumont and Foothill were the two highest producing oat varieties. In the legume silage trials, Titan field pea had the highest yield and Bellevue field pea the highest protein content at 17.3%. The fababean, Encore, yielded 60% higher than Herz Freya, the lowest yielding fababean. Pioneer 931 sorghum was the best performer at Brooks under dryland and under irrigation at Bow Island, while Funk 83F had the top yield of registered sorghum varieties under irrigation at Brooks.

Cultural Studies

Double cropping spring and winter cereals for silage, hay, or pasture was investigated in several trials. Time of harvesting double cropped cereals as to stage of growth development of the spring cereals (jointing, mid-dough) has given preliminary indications of several options with annual forages depending on the intended use. Intercropping spring and winter cereals for pasture use provides high yields throughout the season and compares favorably with winter cereals seeded alone for this purpose. Intercropping provides high silage yields and the winter cereal component gives consistent forage for the rest of the growing season. Seeding ratios of winter and spring cereals is being investigated to determine the best combination for both land use and forage quality. Rates of 1:2 or 2:1 of spring to winter cereal have no significant yield advantage over rates of ½:1 or 1:½ (1 = 100 kg/ha). This experiment will be modified by dropping the higher rates and incorporating a ½:½ combination.

Several new trials with annual forages were initiated in 1988. Annual alfalfa (non-dormant) has the potential of providing a hay crop during the establishment year of perennial alfalfa. To investigate this, annual alfalfa was seeded at different rates with perennial alfalfa for hay production. Also, trials were seeded to determine the possibility of increasing yields and quality of cereal silage crops and annual pastures by using annual legumes in mixtures. Unfortunately, because of seeder problems, poor stands resulted and this experiment will be reseeded in 1989.

PERENNIAL FORAGE CROP STUDIES

Longevity of Perennial Forages Trial

Evaluations of perennial forage trials seeded in the early 1980s at Brooks and Standard were completed this year. The dryland alfalfa varieties Roamer, Rangelander, and Heinrichs generally yielded higher than the check Beaver at the Brooks and Standard test sites. The bromegrass varieties Baylor and Beacon outyielded the check Carlton at both sites. The crested wheatgrass variety Kirk had yields about 10% higher than Parkway over the past 8 years. Yields of Kay and Juno orchard grass were similar. The yield over 7 years for Mayak Russian wild-rye was 17% greater than for the check variety Swift.

Perennial Forage Cultivar Evaluation

There is a lack of information on the new varieties of forages, especially alfalfa, that have been registered over the past 5 years. New variety trials of alfalfa, tall fescue, and bromegrass were established at Brooks for evaluation over the next 3 years.

Perennial Forage Seed Production

In 1987, trials were initiated to investigate the possibility of producing forage grass seed economically under irrigation.

These trials included meadow foxtail, meadow bromegrass, and reed canary grass. These grasses were chosen because they have a market potential for specific uses such as reclamation and pasture.

The first seed production from these trials occurred in 1988. The hot, dry conditions of spring resulted in very early flowering in all the grasses and there were many blank seed heads. Only a small amount of seed was harvested from the meadow foxtail and reed canary grass plots. Bromegrass withstood the drought better than the other grasses mentioned, therefore seed production was much higher.

There has been increasing interest in forage grass seed production under irrigation. To determine some basic agronomic requirements for the management of irrigated grass seed production, preliminary trials investigating soil water requirements of four different grasses were seeded at Rolling Hills.

SOIL AND WATER AGRONOMY

Program Leader: R. C. McKenzie
Technologist - N. F. Clark

The soil and water agronomy research unit provides research, extension, and expert advisory services in soil and water management for special and horticulture crops, and water use of irrigated field crops. The research responsibilities encompass all aspects of soil and water management of special and horticulture crops: fertilizer use, water use efficiency, salinity tolerance, and tillage. Research in 1988 included some projects which were commenced prior to 1987 when this unit was part of the Irrigation and Conservation Division.

Acknowledgement for assistance with laboratory analysis of soil and plant samples is given to the Soil and Animal Nutrition Laboratory, Edmonton, and the Alberta Land Classification Laboratory, Lethbridge. H. Mundel, Agriculture Canada, Lethbridge, arranged for analysis of safflower samples for oil content. Alberta Environment soils staff at Vegreville provided facilities and gave assistance to root washing and root measurements of monarda and safflower.

RESEARCH PROJECTS

Irrigation of Lentils

In contrast to results from 1987, the yield of Eston increased with increasing amounts of irrigation. Laird yielded much less than Eston and did not respond significantly to irrigation treatments.

Because of heavy weed infestations, the lentils experiment was plowed down and seeded on June 1. This was too late for maturation of Laird, a late maturing variety, but was satisfactory for Eston, an early maturing variety.

Irrigation of Safflower

Two cultivars of safflower, Saffire and S208, were grown near Duchess, Alberta. Due to poor emergence, no yield data was collected on Saffire. Yield of S208 was significantly increased by irrigation.

Rooting Depth of Monarda and Safflower

Root depths were measured of monarda, a new fragrant oil (perfume) crop and safflower, a deep rooted crop which is sometimes grown to dry out recharge areas near saline seeps. Soil cores were collected on a replicated basis from two monarda and two safflower trials. The soil cores were washed to recover roots which were measured by a computerized technique using light interception under a microscope.

The monarda plants sampled were 1 year old and may not have been fully developed. They had appreciable roots to 1.2 m and some roots were present to 1.5 m.

Safflower roots were effective at extracting available moisture to 1.2 m and roots were present to 2.4 m. At the Duchess site, the unirrigated treatment used 90, 35, and 4% of the available water respectively from 0.9-1.2 m, 1.2-1.5 m and 1.5-2.1 m. Safflower at the Standard site had more root development below 1.2 m than that grown at the Duchess site.

Production of Winter Wheat on Standing Stubble in East Central Alberta

A 3-year project was concluded in 1987-88. In 1985-86, demonstration plots of winter wheat were grown at five sites. In 1986-87 and 1987-88 an experiment with seeding rates, fertilizer rates, seeding methods, and seeding dates was conducted at Iddesleigh and Kirriemuir. In the last 2 years, yields were low due to lack of spring rainfall. Winter survival was good at all sites in all years. Winter wheat is a suitable crop in East Central Alberta in those years when there is sufficient fall or spring rainfall. Winter wheat should be tested as a crop on chemical fallow in areas where average fall and spring rainfall may not be sufficient.

Rapid Mapping of Salinity Using an EM38 Meter

Research continued on improving the method of measuring and mapping salinity with a data logger and an EM38 meter towed by a tractor or carried by an operator.

Improvements were made to computer programs which had previously been developed. One of these programs collected and stored data on a field data logger. Other programs converted EM readings to saturated paste extract salinity equivalents. These programs allowed for adjustment of salinity readings according to soil temperature, texture, and moisture conditions. Another program allowed this data to be transferred from the data logger to a microcomputer. Co-ordinates applied allowed the data to be used to prepare a contour map of salinity with a mapping program. A proximity switch was attached to a bicycle wheel reducing slippage and enabling readings at regular intervals.

Moisture and Fertility Changes on Fallow and Stubble

A project was initiated in 1984 to measure the amount of water stored in the soil and changes in soil fertility on fallow and stubble fields in central and northern Alberta. Soil moisture, fertility and precipitation data has been collected from 14 sites totalling 35 site years. This data is being organized and a final report will be completed in co-operation with L. Andruchow, R. Sisko and L. Haney.

New Projects

Preliminary work was done on three new experiments.

An experiment was commenced in co-operation with R. Howard on intensive management of two varieties of irrigated alfalfa hay. A joint project with H. Najda on irrigation management of four grasses (tall

fescue, meadow bromegrass, creeping bentgrass, and Kentucky bluegrass) for seed production was commenced. A project to measure salinity and cold tolerance of a number of tree and shrub species will be commenced in 1989 in co-operation with H. Mathers. In 1988, a map of salinity was made of the proposed site for trees and shrubs. No report will be made in 1988 on these projects. They will be continued in 1989.

CROP PROTECTION AND UTILIZATION SECTION

This Section conducts research, extension, and service programs in plant pathology, entomology, weed control, post-harvest physiology, food processing and quality evaluation, and plant diagnostics. Support is provided to production programs at ASCHRC and to agricultural industries and individual producers, both amateur and commercial, in Alberta. Crop pest surveys, diagnoses of disease, insect, and weed problems, pesticide efficacy testing, evaluation of storage practices, and food product development are examples of some of the work carried out by section staff. Research and extension projects are done co-operatively with other ASCHRC staff and federal/provincial research agencies. Close working contacts are maintained with industry organizations and scientific organizations in Alberta and beyond.

Section Administration and Plant Pathology

Ronald J. Howard, B.S.A., M.Sc., Ph.D., P.Ag. ..... Section Head and Plant Pathologist
Karen Chapman ..... Section Secretary
Edward Moskaluk ..... Laboratory Technician

Post-Harvest Program

James D. Holley, B.Sc., M.Sc., Ph.D. ..... Post-Harvest Specialist/ Plant Pathologist

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Nancy Crowe, B.Sc. (Ag.), M.Sc., Ph.D. ..... Food Scientist
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Weed Control

Rudolph Esau, B.S.A., M.Sc., P.Ag. ..... Weed Control Specialist
Bernice Krause, Dipl. Agr. ..... Technician

Regional Crop Laboratory

David Kaminski, B.S.A., M.Sc., P.Ag. ..... Diagnostician

Horticultural Entomology

Arthur Tellier, Dipl. Hort. ..... Laboratory Technician

Field and Special Crops Entomology - Crop Protection Branch

Jim Jones, B.Sc., M.Sc. ..... Entomologist

PLANT PATHOLOGY PROGRAM

Leader: R. Howard
Technician: E. Moskaluk

The Plant Pathology Program has a mandate to conduct applied research on important diseases of special crops, fruits, greenhouse crops, interior plants, and selected cereal, oilseed, and forage crops. These studies encompass field, laboratory, and greenhouse experiments, as well as disease surveys. Findings from this work and from the research of other scientists are presented to producers through extension programs. Service is a third activity which primarily involves consultative backup to the Regional Crop Laboratory at Brooks. Some plant pathology projects are also discussed in the report of the Post-Harvest Program.

RESEARCH PROJECTS

DISEASES OF SPECIAL CROPS

Evaluation of Processing Pea Cultivars for Root Rot Resistance

Resistance is one of the major methods of controlling plant diseases. Root rot, an important disease of peas caused by various species of soil-borne fungi, has been successfully managed in some production areas by using resistant varieties. To determine the relative susceptibility of some experimental and commercial processing pea varieties to the root rot disease complex present in southern Alberta fields, 19 selections provided by Empress Foods Ltd. of Taber were planted in non-replicated blocks in a commercial field near Broxburn. The field was naturally infested with *Fusarium* spp., *Pythium* spp., and *Rhizoctonia solani*. As each cultivar neared maturity, company representatives took tenderometer readings on the peas and estimated a harvest date. At harvest, a subsample of vines and roots was taken for yield and root rot determinations, respectively.

All cultivars matured within 80 days after planting. EF680 matured the earliest, and Trident, FR77-100, CM0228F, FR8614, Perk, and FR79-152 were the latest. FR79-152 yielded the best, followed by Perk and CM0228F. EF680 and SL24 gave the lowest yields. EF680 and Bolero graded out the best with >70% for sieve sizes 2 and 3 combined. Dual and SL24 had the lowest incidence of root rot, followed by Bolero, Challis, and FR77-100. Dual also had the lowest root rot severity rating, followed by SL24, Bolero, FR77-100, and Challis. Trident and Bonito had the highest incidence and severity of root rot. Considering relative yield and root rot rankings, Dual, Bolero, CM 0228F and FR79-152 were the best-performing cultivars, while Bonito was the poorest.

Survey for Seedling Blight of Safflower

Seedling blight is a common and sometimes serious disease of safflower crops in southern Alberta. The disease reduces stands and yields. Several species of soil-borne pathogenic fungi have been

implicated as causes of seedling blight. To determine the incidence and severity of this disease, ten safflower fields in southern Alberta were surveyed between June 2 and 15, 1988. Disease incidence (% plants with seedling blight) and severity (extent of damage on individual plants) readings and stand counts were taken at ten spots in each field. Diseased plants were collected and analyzed in the laboratory for pathogens.

Seedling blight was found in all fields. Plant stands ranged from 20.6 to 83.3 plants/m^2 ($\bar{x}$ = 34.1) A stand of 40-70 plants/m^2 is considered optimum under Alberta conditions. Seedling blight incidence varied from 5.8 to 53.3% ($\bar{x}$ = 15.7). One field was disced under because of disease. Disease severity ranged from 2.0 to 16.7 ($\bar{x}$ = 6.2 on a scale of 0-100). In general, seedling blight incidence and severity were low in safflower fields. Poor stands were due mostly to dry soil at the time of planting. The predominant fungi isolated and the average percentage of tissue pieces colonized by each were: Alternaria spp. - 44%, Fusarium spp. - 37%, and Pythium spp. - 9%. Rhizoctonia solani was isolated in only one case. Some stem cankers were observed which were caused by high temperatures at the soil line (heat canker).

Efficacy of Nine Fungicides Against Seed-Borne Fungi on Safflower

Safflower seed is often infested with various genera of fungi, some of which are pathogens. These organisms may cause seed decay and seedling blight in the field. To determine the relative efficacy of several seed treatment fungicides, Anchor (carbathiin + thiram), Vitavax Dual Solution (carbathiin + lindane), UBI 2521-1 (carbathiin + thiabendazole), Thiram (thiram), B-3 (diazinon + lindane + captan), Apron-T (metalaxyl + thiabendazole), Rovral ST (iprodione + lindane), Captan Flowable (captan), and DL-Plus (diazinon + lindane + captan) were applied to 'S-208' safflower seed which was heavily infested with various seed-borne fungi. Subsamples of treated seed were assayed for fungi using a blotter test.

All products, except Vitavax, significantly lowered the levels of fungal colonization in treated seed; however, the overall infestation rate remained high for most treatments. Only Rovral ST reduced levels of fungal colonization to below 15%. Alternaria spp. and Botrytis cinerea were the predominant fungi on the seed.

Phytotoxicity of Nine Seed Treatment Fungicides on Safflower and Efficacy Against Seed Decay and Seedling Blight

Details of this trial were reported in the 1988 Pesticide Research Report of the Expert Committee for Pesticide Use in Agriculture, Agriculture Canada, Ottawa.

No fungicides are currently registered in Canada for the control of seed decay and seedling blight on safflower. To obtain phytotoxicity and efficacy data, nine fungicides and fungicide/insecticide combinations were applied to Saffire safflower seed. Germination and emergence were determined in laboratory, greenhouse and field tests.

In the laboratory, a blotter test revealed that Captan + DL-Plus and UBI 2521-1 significantly reduced percent germination relative to an untreated check. In sterilized soil in the greenhouse, Captan + DL-Plus, Captan, UBI 2521-1 and Anchor all had significantly poorer emergence than the check. A trial was also planted in a field at ASCHRC, where low emergence was observed in the Apron-T and Captan + DL-Plus treatments. None of the seed treatments significantly improved germination or emergence compared to the check.

Survey for Virulent Blackleg of Canola

A total of 25 canola fields in Census Divisions 2, 3, 5, 6, and 9 were surveyed for blackleg (Leptosphaeria maculans) infestation. The virulent strain was not detected in these fields; however, a number of other fields in Divisions 2 and 5 were surveyed late in the season. From one of these, a field near Lyalta, the virulent strain was isolated. This constitutes the first reported incidence of virulent blackleg of canola outside of Divisions 7 and 10.

DISEASES OF INTERIORSCAPE PLANTS

Phytotoxicity of Institutional Floor Care Products on Weeping Fig

The use of tropical foliage plants to landscape the interiors of office buildings, malls, and various other institutions is a common practice in Alberta, and their installation and maintenance is a multi-million dollar industry. Large specimens, such as weeping fig trees (Ficus benjamina), are usually situated in floor-level planters and, as such, the soil may become contaminated with floor care products. To assess potential phytotoxic effects of these materials, aqueous solutions were prepared and drenched onto the soil of potted, 4-month-old F. benjamina plants. Each chemical was mixed with water as per the manufacturer's instructions for institutional floor care and the amount applied per pot simulated an accidental exposure such as might occur during regular maintenance. Plant health was monitored over a 3-month period.

A neutralizer (acetic acid) and a metallic floor finish proved to be very toxic and caused heavy defoliation and/or mortality. Two cleaners, a sealer and a stripper, were relatively non-phytotoxic.

DISEASES OF FRUIT CROPS

Survey for Dieback and Canker Disease of Saskatoon

This survey was carried out by R. A. Pluim, a graduate student from the University of Alberta, Edmonton. Twelve saskatoon orchards in the south central, north central, and Peace River regions of Alberta were surveyed in the summer of 1988. A systematic sampling technique was used in which every tenth bush was examined and rated based on symptoms of dieback, exfoliation, canker, shrivelled bark, flagging, and/or the presence of fungal structures. Disease severity ratings were based on the number of main branches affected. Branch samples from each site were collected and taken to the laboratory for isolation and identification of pathogens. Dieback and canker disease was found in all orchards

surveyed. Disease incidence was higher in central Alberta than in the Peace River region. The most severe infections were observed in north central Alberta where 23% of diseased bushes had 25-50% of the main branches affected. In the south central and Peace River regions infection was less severe, generally involving 25% or less of the main branches. The most common symptoms observed were branch tip dieback and cankers with pycnidia. Cytospora sp. was isolated from all samples collected.

Efficacy and Phytotoxicity of Three Fungicides on Saskatoon

Details of this study were reported in the 1988 Pesticide Research Report of the Expert Committee for Pesticide Use in Agriculture, Agriculture Canada, Ottawa.

The purpose of this trial was to obtain efficacy data for fungicides on saskatoon. No such products are presently registered for disease control on this crop in Canada. Easout (thiophanate-methyl), Rovral (iprodione) and Funginex (triforine), in combination with the adjuvant Agral 90, were evaluated for their ability to control brown rot (Monilinia amelanchieris), powdery mildew (Podosphaera sp.), and rust (Gymnosporangium spp.) in an orchard of Smoky saskatoons at ASCHRC. The chemicals were applied as foliar sprays during and following flowering. Visual observations of disease incidence were made during the growing season and berry yields were determined from treated plants. J. G. N. Davidson, Agriculture Canada, Beaverlodge, co-operated in this study and also conducted a similar trial at Beaverlodge.

There were no significant differences between treatments for the average number of berries per cluster at harvest. The Funginex, Rovral, and Agral 90 alone treatments had significantly higher percentages of missing berries compared with the water check. This suggests that they may have been phytotoxic, thereby causing premature fruit drop. Bushes treated with Easout had significantly more brown rot than the other treatments; however, levels of this and other diseases were low due to hot, dry weather conditions which were unfavorable for disease development.

DISEASES OF GREENHOUSE CROPS

Survey of Commercial Tomato Crops for Corky Root Rot

Corky root rot, caused by the fungus Pyrenochaeta lycopersici, is a relatively new disease of tomatoes in Alberta. It can be very destructive, causing substantial crop losses. In order to determine the occurrence of this disease in southern Alberta, six commercial greenhouses in the Calgary-Medicine Hat area were surveyed between June and October. All were using the soil-bed method of production.

Three of the six greenhouses surveyed had corky root rot. In two, disease incidence was 98% or more, severity ranged from moderate to high, and crop vigor was poor. Two greenhouses had a previous history of tomato production, whereas one was growing its first crop in virgin prairie soil. In the latter, it is believed that P. lycopersici was

introduced via soil amendments. In each of two greenhouses, Dowfume MC-2 (methyl bromide + chloropicrin) was applied at 49 and 98 g/m^2 to one-half of a single bay after the crops had been removed. Follow-up sampling of the new plantings in September revealed that the fumigant had only slightly reduced corky root rot incidence. A failure to control the disease was also observed in one of the houses where a single bed was given a solarization treatment.

Survey of Commercial Cucumber Crops for Stem Rot and Canker Diseases

Stem rot and canker diseases appear to be increasing in severity in commercial greenhouse cucumber crops in Alberta. To determine the extent of the problem in southern Alberta, 20 greenhouses in the Medicine Hat-Redcliff area were surveyed in September and October, 1988. Approximately 5% of the plants in each house were visually examined for rot and canker symptoms on the lower stems. Disease incidence was recorded and the presence of fungal pathogens was confirmed by isolation.

Of the 58,864 m^2 of greenhouses surveyed, approximately one-third was covered with polyethylene and two-thirds with glass. Artificial mixes were the most common growing media, followed by soil, rockwool and sawdust. Corona was the most frequently grown cultivar (90% of greenhouses). Levels of stem rot and canker were very high ($\bar{x}$ = 82.8%). A number of crops were pulled early because of this disease. *Pythium* spp. were the most commonly isolated fungi (100% of greenhouses), followed by *Fusarium* spp. (90%), *Didymella bryoniae* (45%), and *Rhizoctonia solani* (25%). Poor sanitation and the failure to use pasteurized growing media were the major factors which favored outbreaks in greenhouses with stem rot and canker diseases.

DISEASES OF FORAGE CROPS PROJECT

Survey for Verticillium Wilt of Alfalfa

From August 23-31, 29 alfalfa fields in the Vauxhall area of southern Alberta were surveyed for Verticillium Wilt (VW). The majority were contracted for production of dehydrated alfalfa products. The disease was found in 16 of the fields surveyed (55%). All but one of the fields were irrigated. Incidence ranged from trace (1%) to severe (>50%). The high concentration of wilt in fields contracted for dehydration (60% of fields) suggests that custom harvesting machinery may have been spreading *V. albo-atrum* from field to field.

EXTENSION AND SERVICE ACTIVITIES

ASCHRC Plant Pathology staff spoke at several growers' meetings, workshops, and short courses. They also made regular contributions to the ASCHRC *Crop Protection Newsletter*. In addition, several miscellaneous publications were prepared. Liaison was maintained with district agriculturists in Region I and the southern part of Region II. Staff were also active in several professional societies and advisory committees. Diagnostic assistance was provided to the ASCHRC Regional Crop Laboratory.

A microcomputer-based Fungicide and Fumigant Information Retrieval System (FFIRS) was developed in co-operation with the Pesticides Directorate, Agriculture Canada, Ottawa. FFIRS was programmed on an IBM PC/AT microcomputer equipped with a 5¼ inch, high-capacity floppy disk drive (1.2 MB) and a 30 MB internal hard disk. The software was written using the Microsoft C Compiler Version 5.0 and IBM DOS Version 3.30. The searcher program takes up ca. 42 KB of disk space and the ASCII label files ca. 2.2 MB.

The program has the capability of searching the full text of labels for single or multiple keywords and for Pest Control Products Act (PCP) registration numbers. A typical key word search is done in a sequential fashion, e.g., a plant or crop name is specified on the first pass and a subset of labels is selected by the program. A disease or pathogen name can be specified for a second pass which is done only on the subset. FFIRS Version 2.1 contains 366 fungicide and fumigant labels, and a basic two-pass search takes ca. five minutes to complete. The information retrieved can be sent to a VDT or printer either as a "shopping list" of label titles or as a full label text.

FFIRS was distributed to selected individuals across Canada for evaluation and some very positive feedback has been received. Further improvements to the program are planned in 1989.

POST-HARVEST PROGRAM

Program Leader: J. D. Holley

The objectives of the post-harvest program are to maximize longevity and quality of horticultural crops stored either in traditional refrigerated or controlled atmosphere facilities, to determine how preharvest and harvest factors such as weather, physiological maturity, level of mechanical injury or diseases, cooling or curing affect storability of horticultural crops; to determine how temperature, relative humidity, rate of airflow and levels of atmospheric gases all affect stored product quality; and finally, to diagnose and find better treatments for major diseases and disorders of potatoes, vegetables, turf, flowers and woody ornamentals.

The post-harvest program was without a project leader from July 1987 to June 1988. New refrigerated and controlled atmosphere storages are now being constructed. This has delayed a full-scale start up of this program.

RESEARCH PROJECTS

DISEASES OF POTATOES

Prairie Potato Breeding Program

Early Blight

Rates of early blight development on 32 seedlings and two cultivars were used to characterize their resistance for the first time in 1988. Infected vines from the previous season were plowed into test plot soil, then rows of each test seedling were established. Percent canopy with blight was estimated for each replicated seedling several times during the growing season. These estimates were used to calculate infection rates for each. Scott-Knott cluster analysis ranked seedlings as susceptible, moderately susceptible, moderately resistant or resistant to early blight.

Verticillium Wilt

A new method was used to assess cultivars for their resistance to infection from Verticillium albo-atrum, a fungal wilt pathogen. Prior to planting, barley seed was inoculated with Verticillium. Eight cultivars were cut and planted by hand in open furrows, and infested barley seed was sprinkled evenly over each tuber. Wilt symptoms did not appear until very late in the season, so interference from natural senescence and blight made accurate foliar disease assessments impossible, therefore discoloration of vascular tissue was used to assess disease resistance. Although infection levels in tubers were low, differences between cultivars were significant. Data suggested that the cultivars tested fall into three resistance classes. Yukon Gold, Shepody and Warba were more susceptible than Superior and Carlton. Russet Burbank, Norchip and Norland were the least susceptible. These results appear to be consistent with data collected elsewhere.

Fusarium Wilt

The method described for testing cultivars for Verticillium wilt resistance was used for a similar wilt disease, caused by the fungus Fusarium oxysporum. Two isolates were used to infest barley seed. Potatoes were planted and inoculated as described previously. Again, vascular discoloration in the tubers gave the most consistent results. There were three resistance classes for this disease. Superior, Yukon Gold, Shepody and Warba were more susceptible than Carlton. Carlton was more susceptible than Russet Burbank, Norland or Norchip.

Rhizoctonia Canker and Black Scurf

Two cultivars and 17 seedlings from the Prairie Potato Breeding Program were planted and inoculated as described previously for wilts. Percentages of lower stems affected by Rhizoctonia canker differed between seedlings. A Scott-Knot cluster analysis ranked seedlings as susceptible, moderately susceptible or moderately resistant. Levels of black scurf on tubers were so low that there were no differences between

seedlings. The level and uniformity of soil inoculum needs to be increased next year.

Survey of Potato Storages:

Bacterial Soft-rot:

Seed piece decay and blackleg, caused by the bacterium Erwinia carotovora pv carotovora, have become increasingly common on potatoes particularly in southern Alberta. Germination was reduced by as much as 40% in some fields in the spring of 1988. To determine why bacterial seed piece decay has increased so dramatically, a survey of potato seed storages was initiated in November of 1988. Populations of the soft-rot organism on potatoes from seven major storage facilities ranged from 0 to 50 million bacteria per square centimeter of skin sampled. Tubers placed in anaerobic wet conditions developed soft rot that destroyed 5-85% of the original tissue. Tubers with high surface populations of bacteria tended to rot more extensively when placed in unfavorable conditions. There were some exceptions, however. This suggests that both bacterial population and tuber resistance determine whether tubers are prone to soft-rot.

Silver Scurf:

Major potato processors, Old Dutch, Hostess Foods and York Farms, are experiencing increased difficulty in peeling potatoes mechanically because of silver scurf. In one commercial bin, over 70% of the potatoes were affected. A recent publication from Great Britain showed that the fungus that causes silver scurf, Helminthosporium solani, can develop resistance to the fungicide, thiabendazole (Mertect). Thirty-five pure isolates of this fungus were recovered from storages across Alberta. Preliminary observations have shown that potatoes are not being covered adequately with the fungicide when they are put into storages at harvest.

DISEASES OF TURFGRASS

Fairy Ring Control

Four chemicals, Safer's Natural Fungicide, Hexaconazole, Flutolanil and a surfactant, Chem-Free, were tested in culture for fungitoxicity to Marasmius oreades, the fairy ring fungus. They were applied concurrently to fairy rings at the Eastbrook school yard in Brooks. Flutolanil and Hexaconazole showed appreciable fungitoxicity in lab tests; both chemicals were able to inhibit fungal growth by 50% at a concentration of 0.05 mg/L in potato dextrose agar. Both chemicals also inhibited mushroom production in 1988 trials and showed evidence that they continued to reduce symptoms severity in the 1986 trials. Safer's Fungicidal Soap was phytotoxic to turf. Chem-Free, failed to give convincing results either in the lab or in the field.

EXTENSION ACTIVITIES

Approximately 24,000 acres of potatoes were inspected for bacterial ring rot in 1988. There were six confirmed cases of this disease. Ring rot usually was found on farms that did not use certified disease-free seed. Since planting certified seed is not mandatory in Alberta, it is critical to maintain careful vigilance. Monoclonal antiserum was used to verify the presence of Clavibacter michigenensis pv corynebacterium.

Seminars describing symptoms and aggressiveness of Dutch elm disease were presented to all new U.S./Alberta border station personnel to make them aware of the importance of the firewood confiscation program. Since Dutch elm disease has been reported in Regina, Saskatchewan, and Great Falls, Montana, a contingency plan is being drafted to identify and deal with suspected cases of this disease.

Potential problems with onion neck rot were dealt with at harvest at two facilities in southern Alberta. Steps were taken to prevent the re-occurrence of Thevialopsis blight of carrots.

A new disorder, grey or white knot of potato, was seen for the first time this season. This disorder severely affects the appearance and quality of chips. A paper was given on this disorder at the Alberta potato conference in November.

Leak disease caused extensive losses this season in several potato storages. Potatoes in one major facility could not be used for seed but had to be shipped for chipping in early November. Growers were given advice to prevent the problem next season.

A new factsheet on potato diseases was prepared for the Alberta Potato Marketing Board. It will be published in 1989.

Participation continues on the Dutch Elm Action Committee and the Potato Research Committee.

FOOD PROCESSING AND QUALITY EVALUATION PROGRAM

Leader: N. Crowe
Technicians: M. Dench and J. Hung

The Food Processing and Quality Evaluation Program (FPQEP) has three major objectives: to undertake research on horticultural and special crops produced in Alberta, to provide extension to processors of these crops, and to perform chemical and sensory analyses as requested by other ASCHRC research staff, processors, and growers.

RESEARCH PROJECTS

FRUIT CROPS

The Effect of Extended Frozen Storage on the Quality of Saskatoons

Practical experience in our laboratory indicates that the flavor of saskatoons deteriorates during extended frozen storage. To better understand the nature and rate of this deterioration, a study was initiated on the 1988 crop. Saskatoons (Smoky) were machine harvested from the ASCHRC plots, hand cleaned and bulk frozen at -20°C. After one week of frozen storage, samples were analyzed for moisture, sugar content, and pH.

Flavor volatiles were quantified by headspace analysis and color was determined using the Hunter Lab colorimeter. Analyses were performed at harvest and after 6 months of frozen storage. The analyses will be repeated at 6 month intervals for 2 years from the time of harvest.

During the first 6 months of storage, the pH of the saskatoon fruit was increased by 0.1-0.3 pH units. No substantial changes in moisture, sugar content, volatiles, or color were observed.

Physicochemical Characteristics of Saskatoon Cultivars

Smoky is the most widely planted saskatoon cultivar in Alberta because of its favorable agronomic characteristics and the availability of plant supply. This has resulted in Smoky becoming a standard within the industry. Ten saskatoon cultivars grown at ASCHRC (Forestburg, Honeywood, Moonlake, Northline, Parkhill, Pembina, Regent, Smoky, Success, Thiessen) were evaluated for various physical and chemical characteristics. Each cultivar was examined for average berry weight, berry size, seed number, and seed size. The analyses performed included pH, moisture, refractive index, and quantification of glucose, fructose, and sucrose.

Seed size and number are important as they relate to ease of processing and perception of 'seediness' in saskatoon products. The tendency of the 1988 crop to have larger seeds than the 1986 crop may have been a result of the growing season. The cultivar Smoky had more and larger seeds per berry than most of the other cultivars. Although Thiessen, Smoky, Northline, and Parkhill each had an average of 10 seeds/berry, those in Thiessen weighed proportionately less per berry. Berries from the cultivar Honeywood had the lowest pH values in both 1986 and 1988. Although the pH of Thiessen berries (pH 4.13) was not markedly different from that of Smoky berries (pH 4.16), the Thiessen fruit gave a more tart impression when tasted.

Saskatoon Leather

In view of the increased saskatoon acreage in Alberta, research to develop saskatoon products continues. Further refinements were made to the saskatoon leather previously developed in the ASCHRC laboratories.

A series of in-house sensory panels was used to evaluate leathers prepared by using various ratios of saskatoon puree and applesauce. The products were rated for flavor, texture, and appearance. A 50:50 saskatoon:applesauce leather was the preferred product.

VEGETABLE CROPS

Vegetable Leathers

The goal of this project was to develop a vegetable leather as a potential use for culled vegetables. The investigation dealt with both carrots and tomatoes but, to date, only the carrot-based product has been successful. Formulas evaluated were: a) unadulterated vegetable puree, b) an apple-vegetable puree, c) each of the purees combined with various organic acids, and d) each of the purees combined with pectins and gelling agents.

Results from sensory panels indicated that a formula containing carrot puree, rhubarb juice, pectin, and a small amount of sugar was the most acceptable. Samples of the carrot leather were made available to the public at the 1988 ASCHRC Field Day and received a very positive response. Nutritional and shelflife analyses are being carried out.

POTATOES

Procedures to Reduce Sloughing in Boiled Potatoes

Sloughing occurs when the outer layers of cooked potato flesh fall off or "slough" before the interior of the potato is completely cooked. This phenomenon is most obvious in boiled potatoes, although in severe cases, it can occur in baked potatoes. As no specific recommendations are available in the literature, this study was conducted to establish what specific treatments, if any, were effective in minimizing sloughing.

Soaking potatoes in calcium chloride solutions (5 and 10%) for 30 minutes at 50° or 70°C prior to boiling eliminated sloughing. This treatment is not recommended, however, as it was accompanied by the formation of a tough outer skin after cooking. Results showed that prewarming potato pieces in water alone (50° or 70° C; 30 minutes) reduced sloughing. No tough skin formation occurred and although a small amount of sloughing was evident, this latter treatment is recommended. Potatoes taken out of cold storage (4°C) did not slough until they had been kept at room temperature for 1-2 weeks. Sloughing in potatoes stored at 22°C can be reduced by subjecting the tubers to a temperature of 4°C for 5-7 days. At the commercial level, the facilities and supplies available will determine the appropriate method to reduce sloughing.

SPECIAL CROPS

Distillation of Essential Oils from Alberta-grown Herbs and Spices

This research was part of a Farming for the Future project done in co-operation with the Special Crops Program at the ASCHRC. When analysis of the 1988 crop has been completed, approximately 250 samples will

have been distilled using the water cohabitation distillation method. Twenty different spices were evaluated to give an overview of the quality and potential of Alberta-grown herbs and spices.

EXTENSION AND SERVICE ACTIVITIES

FPQEP staff provided culinary and analytical analyses for processors, growers, and other ASCHRC staff. The Culinary Lab co-operated in the Prairie Potato Breeding Program by doing all of the quality analysis, i.e., chipping, frying, boiling, and baking, of potatoes from one of the Regional Trial sites. The Analytical Lab staff performed glycoalkaloid and sugar analyses on growers' potatoes as well as on numbered selections from the Regional Trials. Moisture, pH, freezing quality and chlorophyll content were evaluated on various fresh and processed fruits and vegetables.

Technical training and advice was provided to several individuals initiating cottage industry jam operations. Liaison with other agriculture and food related agencies, e.g., Leduc Food Processing Centre, Alberta Agriculture Marketing, Canadian Food Products Development Centre, and Agriculture Canada was maintained. Staff continued to play an active role in the regional and national levels of professional societies by chairing technical sessions and presenting scientific papers.

WEED CONTROL PROGRAM

Leader: R. Esau
Technologist: B. Krause

The major objectives of the Weed Control Program are: to improve existing weed control practices for vegetables, potatoes, fruit, and nursery and special crops by evaluating commercial and experimental herbicides; to assist with the diagnosis of herbicide injury and the identification of plants submitted to the ASCHRC Regional Crop Laboratory; and to provide weed control information to commercial and non-commercial growers. Further details of all research trials appear in the 1988 Weed Control Trials, ASCHRC Pamphlet #89-14.

RESEARCH PROJECTS

WEED CONTROL IN VEGETABLE CROPS

Onions - A trial to evaluate bromoxynil (Torch) for use in onions at three different growth stages was repeated. Onions in the flag leaf stage were more susceptible to injury than at later growth stages. Aries appeared to show greater sensitivity to bromoxynil than Norstar and Improved Autumn Spice.

In an onion screening trial, oxadiazon (Ronstar) and MCDS (monocarbamide dihydrogensulfate), commercially sold as Enquik, provided good crop safety and weed control. MCDS (15% nitrogen and 16% sulphur) controlled redroot pigweed and wild mustard, but lamb's-quarters and grasses were not affected. Oxadiazon effectively controlled lamb's-quarters and provided some residual weed control.

Peas - One trial with post-emergence treatments was conducted for broad-spectrum weed control in peas. Two formulated mixtures and one tank mixture of bentazon plus MCPA amine were applied after crop emergence. They caused temporary crop injury which disappeared after one month; all treatments yielded significantly higher than the weedy check.

In a second trial with a similar objective, preplant incorporated (PPI) herbicides, namely ethalfluralin (Edge), metribuzin (Sencor, Lexone), and RE 40885 (Benchmark) were evaluated. RE 40885 at 0.8 and 1.2 kg a.i./ha produced unacceptable crop injury, whereas ethalfluralin and metribuzin did not injure the crop. Some of the PPI treatments will be studied further, including comparison of fall vs. spring applications.

Cabbage - Pyridate (Lentagran), napropamide (Devrinol), and DPX-A7881 (Muster) were tested with trifluralin (Treflan/Rival) for control of weeds not controlled by trifluralin alone. Herbicides tested did not injure cabbage. DPX-A7881 controlled small wild mustard seedlings and pyridate and napropamide partially controlled common groundsel.

Squash - The use of herbicides for the production of zucchini squash was not warranted when the crop was grown with a soil-covered clear plastic mulch. When squash was grown without plastic mulch, chloramben (Amiben) at 3.4 kg a.i./ha gave acceptable control of common purslane, redroot pigweed, and lamb's-quarters, but caused some crop injury.

In another trial, three rates of dazomet (Basamid) were incorporated into soil. The treated areas were then covered with clear plastic mulch about three weeks prior to seeding. No significant yield differences between rates or the untreated check were recorded.

WEED CONTROL IN SASKATOONS

Two trials were conducted in the Peace River region with technical assistance by S. Kitt. In established saskatoons at Sexsmith, shoot growth was not affected by any of the seven herbicidal treatments applied in April, 1988. While crop injury was not observed, none of the herbicides tested (simazine, napropamide, oxadiazon and linuron) controlled established dandelion which was the major weed.

A trial with newly planted saskatoons showed that linuron (Lorox, Afolan) at 2 kg a.i./ha controlled the common annual broadleaved weeds without any crop injury. Trifluralin was also tested, however, it failed to control the weeds in the trial. In a new trial, dichlobenil (Casoron) was applied at three sites to established saskatoons in late October for evaluation in 1989.

CONTROL OF GRASSES IN HORTICULTURAL CROPS

Graminicides were evaluated in three trials with potatoes, carrots, cabbage and green peas. All four crops showed excellent crop tolerance to the graminicides which were tested. Addition of liquid ammonium sulphate to clethodim (Select) improved its activity on annual grasses.

WEED CONTROL IN POTATOES

Several combinations of sethoxydim (Poast) and bentazon (Basagran), or metribuzin (Sencor, Lexone) were tested for post-emergence weed control in potatoes. They were compared with the current standard treatment, EPTC (Eptam) + metribuzin, which was applied and incorporated prior to planting. A tank mix of sethoxydim + ammonium sulphate + Assist + metribuzin was one of the treatments tested which provided yields equivalent to the hand weeded check and the standard treatment.

WEED CONTROL IN PULSE CROPS

An on-going co-operative trial with R. Blackshaw, Agriculture Canada, Lethbridge, on the control of hairy nightshade and wild tomato (cutleaf nightshade) in dry beans was conducted. Although nightshade seeds were sown, the resulting populations were too low for assessing control. Data were obtained on crop tolerance and control of redroot pigweed and lamb's-quarters. Work on the control of nightshade species in drybeans will be continued.

WEED CONTROL IN NURSERY CROPS

Two trials with nursery container stock were conducted at ASCHRC. In one trial, ten herbicidal treatments were applied to Nanking cherry, Baileys dogwood and Senateur Vollard lilac. Tolerance to granular formulations of trifluralin (Treflan), napropamide (Devrinol) and oxadiazon (Ronstar) was excellent for all three species. In a second trial, Nanking cherry was not adversely affected by dichlobenil (Casoron G4) at 3.0, 4.5 and 6.0 kg a.i./ha.

In a field trial with newly-planted Brooks #6 poplar, ten herbicidal treatments were evaluated for efficacy and crop tolerance. Growth was reduced by DPX L5300, AC222,293 (Assert) and AC263,499 (Pursuit), whereas, clopyralid (Lontrel), DPX-M6316 (Refine), fomesafen (Flex), oxadiazon (Ronstar), linuron (Lorox, Afolan) and linuron + HOE 039866 (Ignite) did not cause any injury. With the exception of DPX-M6316, the other potential herbicides will be followed up in further trials with selected tree and shrub species.

HERBICIDE CARRY-OVER

Plots to which chlorsulfuron (Glean) was applied in 1984 were again recropped to canola, lentils, alfalfa and potatoes. Five years after application, the 2X rate (40 g a.i./ha) was observed to injure alfalfa, lentils, potatoes and canola. Yields of alfalfa, potatoes and canola, however, were not significantly different from the control. These recropping trials with chlorsulfuron have been terminated.

HERBS AND SPICES

Two replicated trials and one non-replicated trial were conducted to determine tolerance of 13 herbs and spices to various herbicides. Results from these trials provided promising leads which will be followed up in the future. Funding was provided by a Farming for the Future Program research grant.

EXTENSION AND SERVICE ACTIVITIES

A factsheet Guide to Weed Control in Potatoes was prepared and the weed control recommendations in the Alberta Vegetable Production Guide were updated.

The Weed Control Specialist participated in various seminars, commodity field tours and program reviews and served as planning chairman for the Alberta Institute of Agrologists (AIA) Annual Meeting and AIA Southeast Branch Technology Transfer Session. A weed field day was held on July 26 for weed research and extension specialists.

The Weed Control Program is currently co-operating with two chemical companies in studying the persistence of triasulfuron and sulfosate (glyphosate) at ASCHRC.

REGIONAL CROP LABORATORY PROGRAM

Project Leader: D. Kaminski
Consultants: R. Howard, R. Esau, A. Tellier, C. Linowski, J. Holley, J. Jones

The southern Alberta Regional Crop Laboratory (RCL) received a total of 1460 plant disease, insect, and plant identification specimens in 1988. This figure was up 21% from the previous year when 1209 specimens were received. An appeal was made again to those who submit samples on behalf of the public to screen samples of a non-commercial nature as much as possible. The desired effect of reducing the percentage of domestic specimens was not achieved, rather the numbers of such specimens were up 5%, 10% and 17% in plant disease, insect, and plant identification categories, respectively.

The summaries that follow were detailed in the January '88 issue [Vol. 13(1)] of the ASCHRC's Crop Protection Newsletter. Again in 1988, all diagnostic records were stored on an IBM PC/AT microcomputer using dBase III Plus software.

Phone inquiries were handled by the ASCHRC Information Officer and by the Regional Crop Laboratory Technician. The total number of calls, 6589, was up 13% from the previous year. In July and August, there were more than 1200 calls per month.

Table 1. Summary of plant disease, insect, and plant identification specimens received at the southern Alberta Regional Crop Laboratory (January 1 to December 31, 1988).

Category	No. of Specimens	% of Total	% Commercial
Plant Disease Specimens			
Woody Ornamental	199	24	4
Vegetable Crop	186	23	50
Greenhouse Crop	102	12	80
Cereal	101	12	97
Fruit	68	8	12
Interior Plant	50	6	52
Herbaceous Ornamental	36	4	22
Forage	34	4	100
Special Crop	15	2	73
Oilseed	14	2	71
Miscellaneous	11	1	0
TOTAL	816	100	46
Insect Specimens			
Woody Ornamental	132	37	2
Household Pest	78	22	1
Miscellaneous	38	11	0
Cereal	26	7	96
Herbaceous Ornamentals	19	5	10
Vegetable Crop	17	5	0
Greenhouse Crop	16	5	81
Fruit	11	3	9
Oilseed	8	2	25
Interior Plant	6	2	0
Forage	5	1	80
TOTAL	356	100	15
Plant Identification Specimens			
Park/Yard/Garden	76	40	3
Miscellaneous	29	15	10
Forage Crop	24	13	100
Annual Crop	18	10	83
Fallow	16	9	94
Pasture	12	6	83
Waste Area	7	4	29
Water Course/Slough	4	2	50
Brush/Forest/Land	1	1	100
TOTAL	187	100	38

HORTICULTURAL ENTOMOLOGY PROGRAM

Leader: R. Howard
Technician: A. Tellier

The Horticultural Entomology Program conducts research and provides extension and diagnostic services. Research is directed toward major pest problems on selected horticultural crops. Extension assistance is provided to Alberta's agricultural industries, individual growers, and Alberta Agriculture extension staff. Diagnostic services are provided for clients of the ASCHRC Regional Crop Laboratory and ASCHRC researchers. Pest control recommendations are often made in conjunction with diagnoses rendered on specimen submissions by commercial and amateur producers.

RESEARCH PROJECTS

GREENHOUSE PEST MANAGEMENT

Biological Control of Western Flower Thrips (WFT)

The Horticultural Entomology Program provided on-site supervision and technical assistance to a research trial organized by M. Steiner, Alberta Environmental Centre, Vegreville, and funded by a Farming For the Future Program grant. The objective of this program was to test the effectiveness of a predatory mite, Amblyseius cucumeris, in lowering thrips numbers and reducing fruit damage. Also, WFT were tested for resistance to several insecticides.

Seventeen commercial cucumber greenhouses in Redcliff were monitored for numbers of WFT throughout the 1988 season. Initial leaf damage by thrips was high in ten greenhouses using predatory mites, but damage to fruit was lower than in seven greenhouses using insecticides. The group of greenhouses using chemical control had an average of 40% lower yield than those using biological control. This reduction was due to insecticide damage to plants and to insecticide resistance in thrips populations. DDVP (dichlorvos), Talstar (bifenthrin), Safer's Insecticidal Soap and Plant Products Dormant Oil were not effective against WFT. Thiodan (endosulfan) was more effective than Lannate (methomyl), partly because of resistance to Lannate in high use areas. This trial will be repeated in 1989.

Biological Control of WFT Using Minute Pirate Bugs

A native predatory bug, Orius tristicolor, was collected from local alfalfa fields and introduced to six commercial greenhouses and to ASCHRC's research greenhouses. Its effectiveness was monitored weekly using the same methods as for A. cucumeris. Collections and introductions were done from mid-May until mid-October. Excellent control of WFT was achieved in two of the greenhouses when the minute pirate bug was introduced at approximately two bugs/plant. Control was satisfactory in the other greenhouses. Rearing and storing studies are presently being done by D. Gillespie, Agriculture Canada, Agassiz, B.C., and

Applied Bio-nomics Ltd., Sidney, B.C. This trial will be continued in 1989.

CONTROL OF FRUIT PESTS

Efficacy of Five Insecticides on Bearing Saskatoons

Five insecticides were tested for their efficacy against aphids, two-spotted spider mites, leaf miners, and pear slugs on fruiting saskatoon bushes in an orchard at ASCHRC. Decis 5 EC (deltamethrin 50 g/L), Decis F (deltamethrin 5 g/L SU), Basudin (diazinon 500 g/L EC), Sevin XLR (carbaryl 480 g/L SU), Safer's Insecticidal Soap (potassium salts of fatty acids, 50.5% SN), and the adjuvant Agral 90 (nonyl phenoxy polyethoxy ethanol, 90% SN) were tested.

The overall severity of insect infestation in the test orchards was relatively low. None of the treatments significantly reduced the average number of insect-damaged berries/cluster, but on a percentage basis, fruit treated with Decis EC, Sevin XLR, and Basudin had significantly less damage than the water control.

PEST SURVEYS

Dutch Elm Disease/Elm Bark Beetle Survey

Fifteen sites throughout southern Alberta were monitored monthly for elm bark beetles. Pheromone and log traps were put out in early May and the last collection made in mid-October. No elm bark beetles, Hylurgopinus rufipes Eichoff and Scolytus multistriatus Marsham, were picked up on pheromone or log traps, respectively. Elm logs from four truck loads of confiscated firewood were examined, no elm bark beetles or evidence of their activity was found. All of the firewood was subsequently destroyed. Several elm samples were submitted to the ASCHRC from various urban locations and all proved negative for DED.

Sweet Potato Whitefly

Alberta poinsettia growers faced a new pest, the sweet potato whitefly (Bremsia tabaci), which came in with cuttings in 1988. Several greenhouse visits were conducted in response to inquiries from growers who felt they had found SPW on their crops. Growers who had infested crops were advised to fumigate and spray every three to four days until control was achieved. SPW could cause serious problems in vegetable greenhouses, especially in those using a biological control program. As well, insecticides registered on vegetable crops are limited compared to ornamental crops and may not be effective against SPW. Many vegetable growers were issued permits to purchase Sulfotep (Plant Fume 101) to use as a clean-up procedure prior to the removal of their crops.

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APPENDIX I. METEOROLOGICAL REPORT

Summary of 1988 Weather Conditions

The 1988 spring was early, with temperatures in March over 5°C above a 33-year average. April and May were extremely dry, with no precipitation recorded in April and only 4 mm during May.

The growing season began May 3 and ended October 18, a total of 167 days. The season was characterized by below normal precipitation and above average temperatures with total heat accumulation of 2798 corn heat units.

Table 2. Maximum, minimum, and mean temperatures (°C) at the Alberta Special Crops and Horticultural Research Center, Brooks, 1988

	Max.	Min.	Mean	Prec. (mm)	Sunshine (h)
January	8.9	-31.7	-10.2	0.7	100.7
February	16.6	-31.6	-6.2	9.0	118.1
March	18.7	-13.4	1.9	22.6	151.7
April	24.0	-8.6	6.8	0	296.2
May	31.5	-3.7	14.5	4.0	295.0
June	31.9	7.9	19.3	108.2	314.6
July	35.4	7.3	19.0	9.6	337.9
August	33.8	4.2	17.2	43.0	298.5
September	32.3	-0.5	12.6	26.0	210.4
October	26.4	-13.8	8.1	0.6	202.8
November	18.2	-24.8	-1.4	7.5	90.1
December	16.6	-31.2	-7.0	16.7	72.4

APPENDIX II. TERMS OF REFERENCE ASCHRC ADVISORY COMMITTEE

PURPOSE

The ASCHRC Advisory Committee is a permanent committee established to be advisory to the ASCHRC Director.

MEMBERSHIP

Membership on the committee is by invitation, and includes representation from industry associations and associated organizations. Representation is by appointment through the association or by the Director, ASCHRC.

1. Industry Representatives - Grower Organizations

    - Landscape Alberta Nursery Trades Association
    - Alberta Greenhouse Growers Association
    - Alberta Vegetable Growers Marketing Board
    - Alberta Fresh Vegetable Marketing Board
    - Alberta Market Gardeners Association
    - Alberta Potato Marketing Board
    - Pulse Growers Association of Alberta
    - Flowers Canada - Alberta Region
    - Fruit Growers Society of Alberta
    - Red Hat Co-operative

2. Industry Representatives - Non-grower

    - Alberta Potato Processors
    - Horticultural Supply Specialists
    - Empress Foods Ltd.

3. Associated Organizations

    - University of Alberta - Plant Science
    - Agriculture Canada Research Station - Lethbridge
    - Alberta Agriculture Regional Director (Region I or II)
    - Alberta Tree Nursery and Horticulture Centre - Director
    - Field Crops Branch, Alberta Agriculture - Head
    - Director, Plant Industry Division

4. Community Representative

5. Director, ASCHRC

OBJECTIVES

1. The committee shall regularly review and critique ASCHRC programs.

2. The committee shall recommend new research and extension program initiatives; and assist in the establishment of priorities for existing programs.

3. The committee shall deal primarily with matters pertaining to ASCHRC research and extension programs, and not necessarily with broad industry related problems, e.g. marketing, except as they may influence program objectives.

MEMBERSHIP RESPONSIBILITY

1. To attend all meetings as scheduled, and to represent their area of interest from an overall industry point of view.

2. To provide input to meetings reflecting the needs of agency members and producers which they represent to ensure that they be addressed by the ASCHRC. Written submissions are preferred.

3. In regard to Committee Objective #1, members should attend regularly scheduled program reviews in their commodity area. (These reviews are planned biennially.)